Status of the preparation for iKAGRA data analysis

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Data Analysis Subsystem (DAS)

Chief: H.Tagoshi
Sub-chiefs: Y.Itoh, H.Takahashi
Core members: N.Kanda, K.Oohara, K.Hayama

Korean subgroup
Leader: Hyung Won Lee

Osaka Univ : H. Tagoshi, K.Ueno, T.Narikawa
Osaka City Univ : N.Kanda, K.Hayama, T.Yokozawa, H.Yuzurihara, T.Yamamoto, K.Tanaka, M. Asano, M. Toritani, T. Arima, A. Miyamoto
Univ Tokyo : Y.Itoh, K. Eda, J. Yokoyama,
Nagaoka Tech : H.Takahashi,
Niigaka Univ : K.Oohara, Y.Hiranuma, M. Kaneyama, T. Wakamatsu
Toyama Univ : S. Hirobayashi, M. Nakano

Inje Univ. : Hyung Won Lee
Jeongcho Kim
Seoul Nat. U.: Chunglee Kim

Total: 26 (Graduate students are included. Undergrad. are not included)
About 30 people in the mailing list.

- DMG-DAS Core members' meeting : Friday 13:00-14:00
- Weekly meeting: Friday 14:00-17:00

Data analysis tasks and people

- CBC Tagoshi H.Takahashi, Kaneyama, Hiranuma, Wakamatsu, Oohara Ueno, Narikawa, Yuzurihara

  CBC-PE H.W. Lee C.Kim, J.Kim, Narikawa
- Burst Hayama Yokozawa, Asano, Kanda,...
- CW Itoh K.Tanaka, Toritani, Eda, Kanda,Tatsumi,

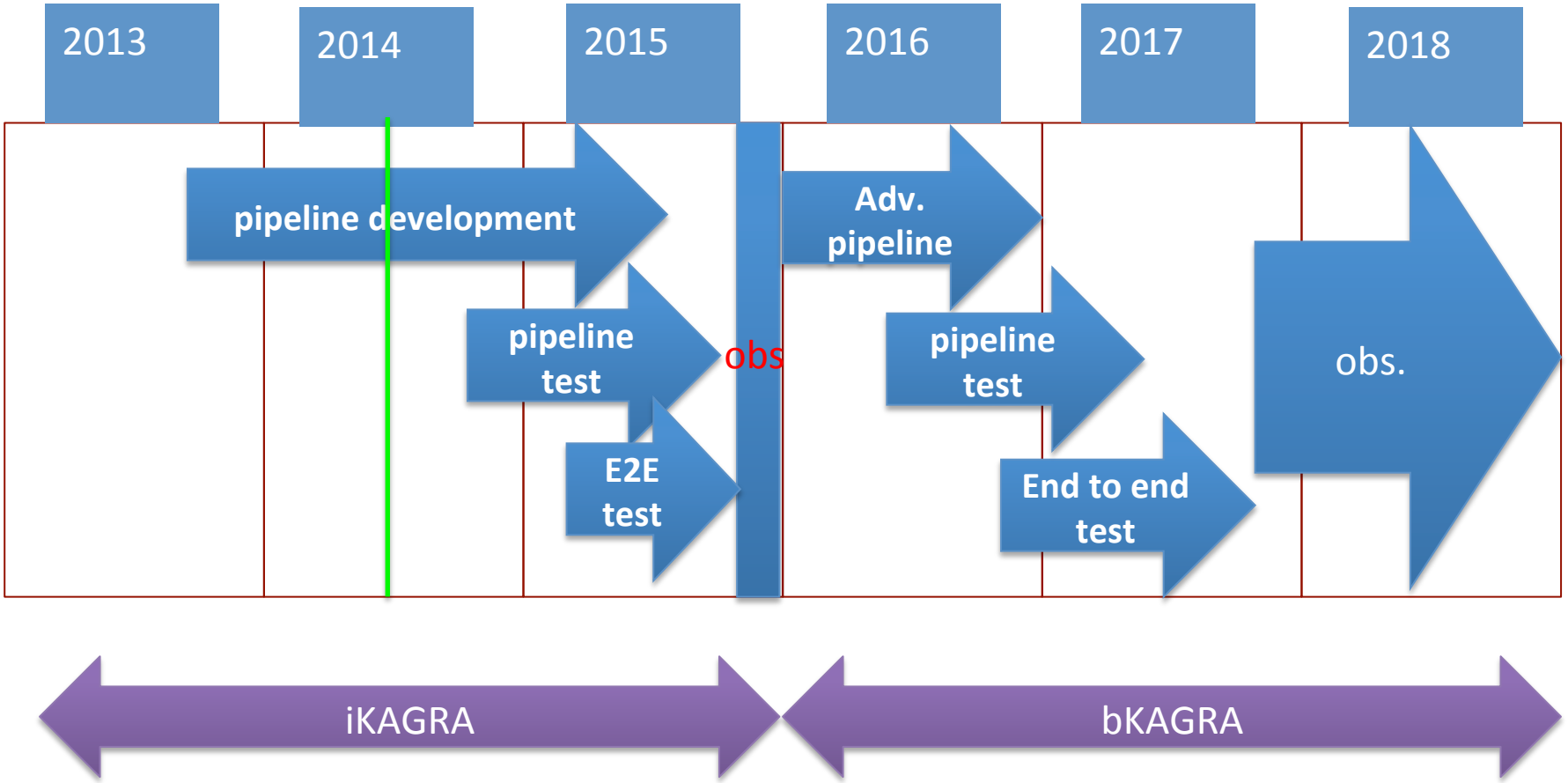
- Stochastic Background TBD

  Radiometry Kanda K.Tanaka

- Calibration Kanda, Yamamoto

- DMG pipeline Kanda, Oohara

Schedule



iKAGRA target

- Operation of the whole analysis pipeline which includes analysis of data and setting upper limits.
- Discovering local fortuitous GW events.

bKAGRA target

- Detection of GW signals
- Joint data analysis with LV
- GW astronomy

CBC

Basic policy:

We develop CBC pipeline by ourselves as much as we can.

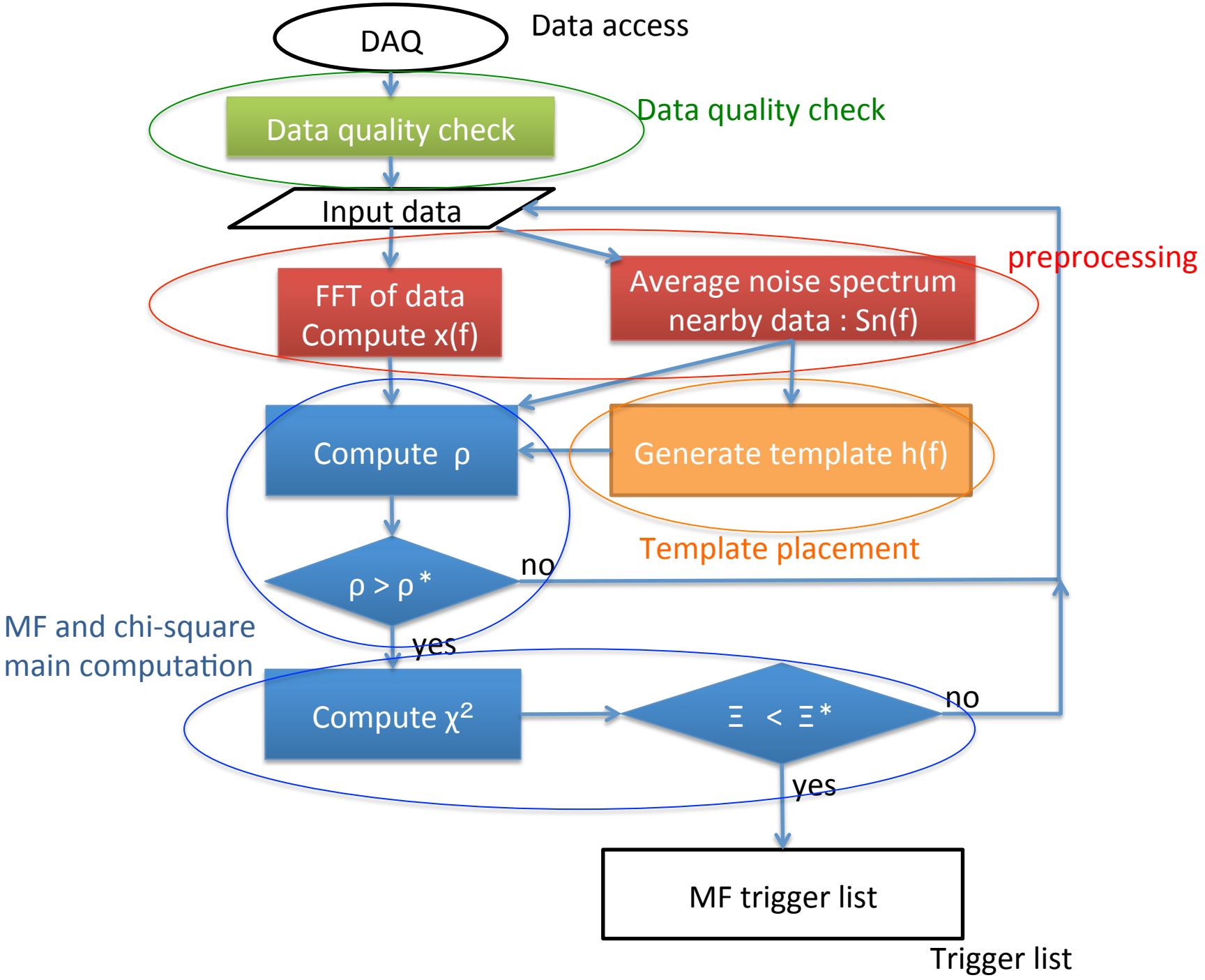
(but this does not mean to prohibit the use of LAL, etc.)

[1] We need to develop the ability of our group, because many of our members are new post-docs or very young students. They need to learn the matched filter analysis from the basics.

To develop the analysis code is good training.

[2] We don't want to use LAL as a black box.

[3] Tagoshi and Takahashi have large amount of experience of CBC analysis during TAMA era.


DAQ
Data access
Data quality check
Data quality check
Input data
preprocessing
FFT of data
Compute x(f)
Average noise spectrum
nearby data : Sn(f)
Compute ρ
Generate template h(f)
Template placement
ρ > ρ*
no
MF and chi-square
main computation
yes
Compute χ²
Ξ < Ξ*
no
yes
MF trigger list
Trigger list

In addition, we need

- Coincident analysis pipeline
- Injection simulation pipeline (to evaluate the efficiency)
- Background estimation pipeline
- Alert system

CBC Schedule

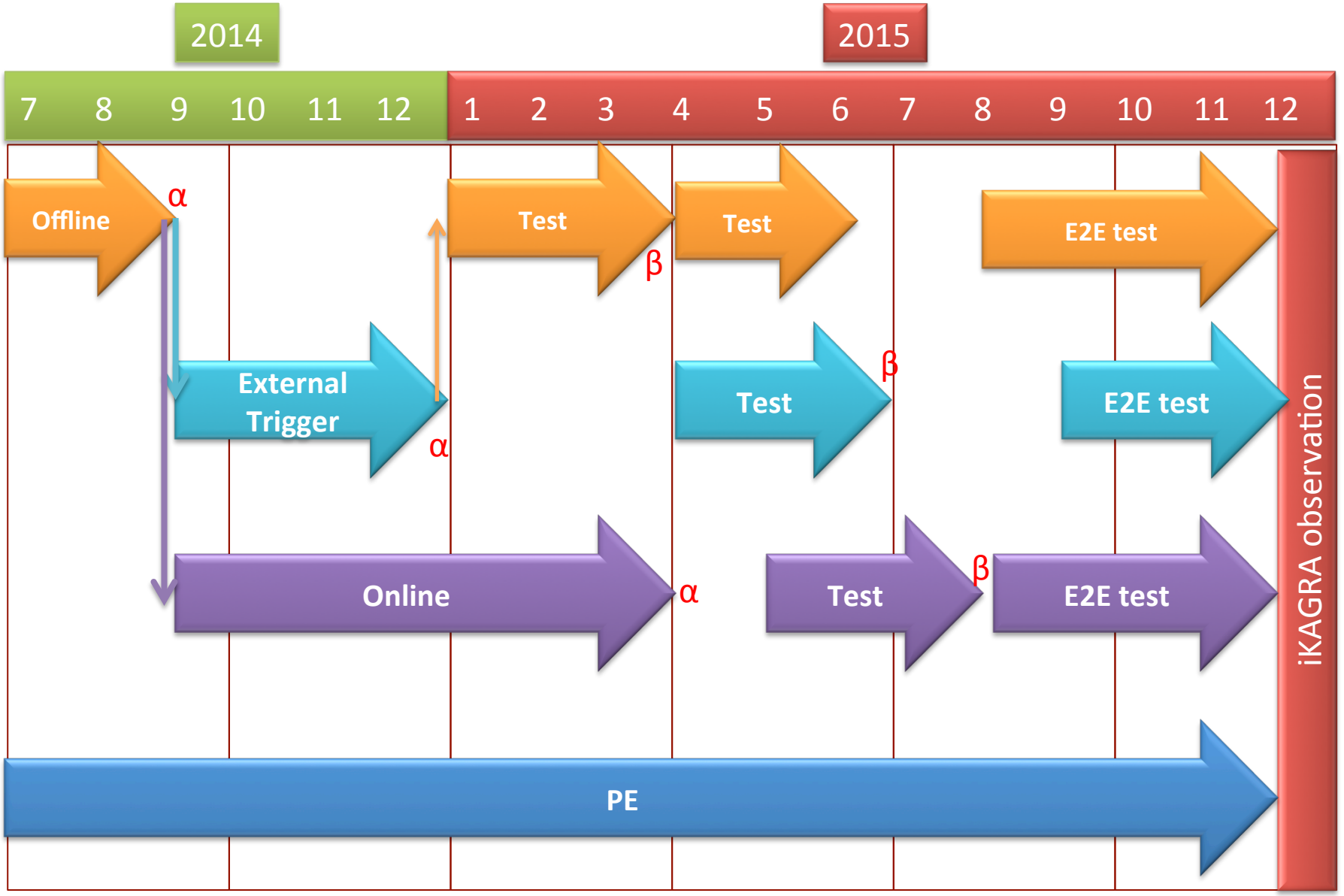
- KAGALI basic component
  and Off line pipeline
  alpha version : 2014/08/31
  beta version: 2015/03

- External trigger pipeline
  alpha version : 2014/12

- On line pipeline
  alpha version : 2015/03

- Parameter estimation pipeline
  alpha version : 2015/06 (to be discussed)

CBC Schedule



Status

- KAGALI Components:

Error handling mechanism

Memory management

FFTW wrapper

Frame wrapper

(Minor change of coding style guide is now being done)

- CBC offline pipeline

Template placement

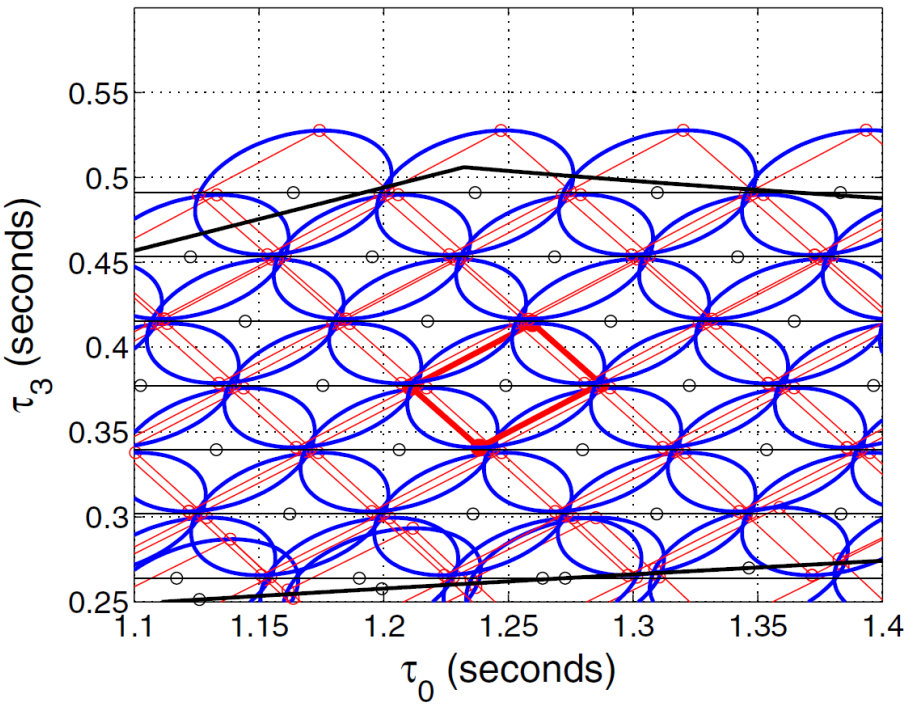
Migration of TAMA pipeline to KAGALI

  - Data access
  - Data quality information
  - Preprocess of MF
  - MF main parts
  - Trigger list

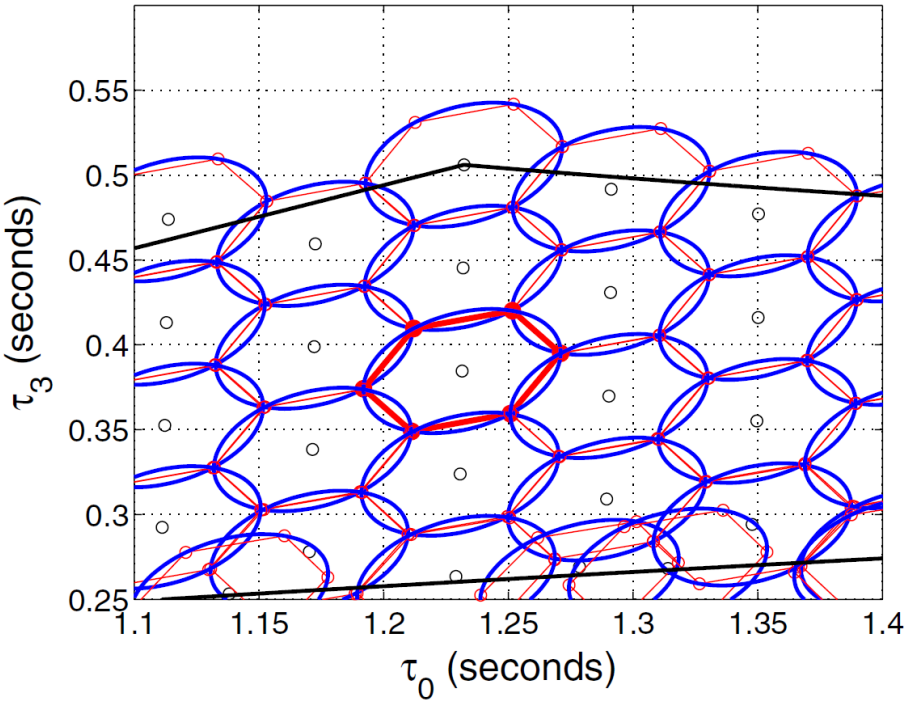
Template placement

Squares vs Hexagons

Square placement

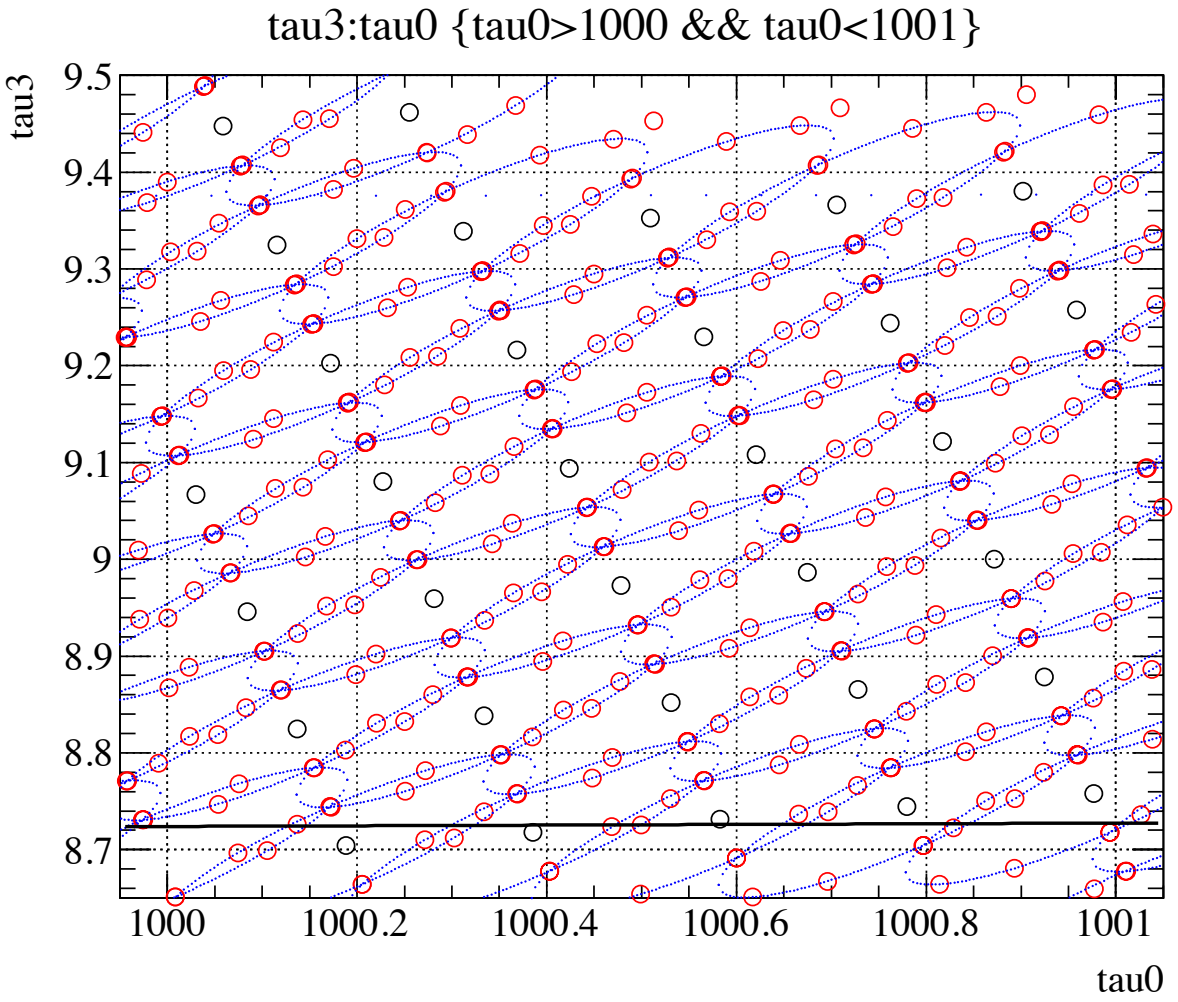


Hexagonal placement



Hexagonal placement

by Koh Ueno



#Template bank
(All: m1∈[1,30] Msun, m2 ∈[1,30] Msun)

by Koh Ueno

fmin [Hz]	10	20	30
Square	294639	168678	101527
Hexagonal	186105	82957	42993

Burst

Policy:

KAGALI, LAL + Haskell wrapper

(low cost, high speed, less error, user friendly)

- Data access with cache file (same for CBC)
- Data conditioning (line removal, whitening,...)

- Event trigger generation

-Time-frequency map

Plan: Q-transform on nonstationary Gabor frame and/or wavelet packet

-Clustering

Continuous wave

Policy: Use LAL as much as possible.

Primary tasks:

- Search for known pulsars by using GPGPU.
  The use of GPGPU is new.

- LMXB search by using LAL code
  Development of optimal search code, and contribution to LSC.

- (F-scan adoption and implementation for line monitor (under discussion))

Basic research on LAL code and documents are going on.

iKAGRA paper plan

Question: can we write papers of data analysis of iKAGRA?

The sensitivity will be much worse than iLIGO.
Length of data will be very short.

One idea:
JPS journal "Progress of Theoretical and Experimental Physics" (PTEP)

A special issue of iKAGRA operation which allow papers which show the operation and data analysis (basically review papers).

This should be published within a few month after iKAGRA operation.

Agreement within KAGRA and negotiation with PTEP are necessary.

DAS has already proposed to EO.